

X-ray outbursts from a new transient in NGC 55

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ABSTRACT

We report the outbursts from a newly discovered X-ray transient in the Magellanic-type, SB(s)m galaxy NGC 55. The transient source, XMMU J001446.81-391123.48, was undetectable in the 2001 *XMM-Newton* and 2004 *Chandra* observations, but detected in a 2010 *XMM-Newton* observation at a significance level of 9σ in the 0.3–8 keV energy band. The *XMM-Newton* spectrum is consistent with a power law with photon index $\Gamma = 3.17^{+0.22}_{-0.20}$, but is better fit with a $kT_{in} = 0.70 \pm 0.06$ keV disk blackbody. The luminosity was $\sim 10^{38}$ erg s^{−1}, and the source displayed strong short-term X-ray variability. These results, combined with the hardness ratios of its emission, strongly suggest an X-ray binary nature for the source. The follow-up studies with *Swift* XRT observations revealed that the source exhibited recurrent outbursts with period about a month. The XRT spectra can be described by a power law ($\Gamma \sim 2.5$ – 2.9) or a disk blackbody ($kT_{in} \sim 0.8$ – 1.0 keV), and the luminosity was in a range of 10^{38} – 10^{39} erg s^{−1}, with no evidence showing any significant changes of the spectral parameters in the observations. Based on the X-ray spectral and temporal properties, we conclude that XMMU J001446.81-391123.48 is a new transient X-ray binary in NGC 55, which possibly contains a black hole primary.

Key words: X-rays: general – X-rays: binaries – X-rays: bursts – X-rays: galaxies – X-rays: individual(XMMU J001446.81-391123.48)

1 INTRODUCTION

Transient X-ray sources have been extensively studied from the beginning of X-ray astronomy. Most of them are binary systems with a black hole (BH) or a neutron star (NS) as the primary. These systems have been primarily discovered when they entered outbursts characterised by an episode of high accretion rates and abrupt increases of X-ray luminosity by several orders of magnitude. During an outburst, the source goes through different spectral states: *low/hard state* (LHS) and *high/soft state* (HSS) are the two principal states of black hole X-ray binaries (BHXBs). In the LHS, the spectrum is described by a hard power law with photon index in the range of 1.5 – 2.0, and in the latter, thermal emission ($kT \sim 1$ keV) from an optically thick and geometrically thin accretion disc dominates. There is also a *steep power law state* (SPL), described by a disk blackbody component plus power law with photon index $\Gamma > 2.4$ (see McClintock & Remillard 2006; Remillard & McClintock 2006, for extensive reviews on spectral states). The outbursts typically last a few months with recurrence period of many years (~ 2 – 57.8 yr; Chen, Shrader & Livio 1997; Kuulkers et al. 1997). NS X-

ray binaries also have such outbursts with much shorter recurrence period (~ 100 – 200 d; Guerriero et al. 1999; Masetti 2002) compared to the BH systems. However, BH and NS systems both show many remarkable similarities in their spectral states (van der Klis 1994; Campana et al. 1998; McClintock & Remillard 2006).

NGC 55 is a Magellanic-type, SB(s)m galaxy and its X-ray properties has been well studied by two *XMM-Newton* observations conducted in 2001 (Stobbart, Roberts & Warwick 2006). They identified 137 X-ray sources in the field of view and classified 42 X-ray sources in the D_{25} region of the galaxy as X-ray binaries (XRBs), supernova remnants, and very soft sources. Moreover, this galaxy hosts a very bright BHXB candidate, which showed a marked upward drift, significant chaotic variability and pronounced dips in the *XMM-Newton* observations (Stobbart, Roberts & Warwick 2004). This particular source belongs to the ultraluminous X-ray source class with X-ray luminosity $> 10^{39}$ erg s^{−1}.

In this paper, we report the outbursts from a new X-ray transient in NGC 55. The transient source was discovered serendipitously from the inspection of archival *XMM-Newton* observations, which were primarily selected for studying the variability of super soft X-ray sources. While a more detailed report on the variability of super soft X-ray

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Table 1. Observation Log

Mission	ObsID	Date	Exposure ^a
<i>XMM-Newton</i>	0028740201, 0028740101	2001 Nov	33.6, 31.5
<i>Chandra</i>	0655050101	2010 May	127.4
	2255	2001 Sep	60.1
	4744	2004 Jun	9.7
<i>Swift</i>	K01 - K07	2013 Apr - May	4.9 - 5.6
	K09 - K20	2013 Jun - Aug	4.5 - 4.7
	L01, L04	2013 Sep - Nov	3.5, 2.7
	M01, M03, M05	2014 Oct	2.9, 2.2, 3.7

Note. — The prefix K, L and M on *Swift* denotes 000326190, 000821200 and 000334680 respectively.

^aExposure time is in units of kilo-seconds.

sources will be presented later, in this paper, we concentrate on this transient which exhibited recurrent outbursts in the *Swift* X-ray Telescope (XRT) observations. In the following, §2 describes the observations and data reduction techniques used. We explain the analysis and results in §3 and discuss the results and possible nature of the transient in §4.

2 OBSERVATIONS AND DATA REDUCTION

We used archival *XMM-Newton* observations of NGC 55 performed in 2001 November and 2010 May. The data from the European Photon Imaging Camera (EPIC) PN detector were reduced and analysed using standard tools of the *XMM-Newton* Science Analysis Software (SAS) version 13.5.0. The full-field background light curve was extracted from the PN camera to remove the particle flaring background and create the good time intervals file. A count rate of ≥ 0.8 ct s⁻¹ in the 10–12 keV light curve was used for the rejection. We used the PN events with the best quality data (FLAG = 0) and PATTERN ≤ 4 , and removed the hot pixels in the data by using the flag expression #XMMEA_EP. The source detection routine (EDetect_CHAIN) was carried out using the standard parameters for EPIC-PN data over the entire energy bands and obtaining the final source list from 2001 and 2010 observations. We corrected the X-ray source positions by correlating the final source list with the USNO A2.0 optical catalogue (Monet & et al. 1998), using the SAS task EPOSCORR.

We also analysed two archival *Chandra* observations conducted in 2001 and 2004. The *Chandra* data were reduced and reprocessed using the science threads of *Chandra* Interactive Analysis of Observations (CIAO) version 4.6 and HEASOFT version 6.15.1. In addition, we used *Swift* XRT observations of the region carried out during 2013 April to 2014 October. We selected the observations with an exposure time of > 2 ks from the *Swift* program, which resulted 24 observations (see Table 1). We reduced the *Swift* data using HEASOFT and the Calibration Database (CALDB) files as of 2014 June 10. We processed the photon counting mode of *Swift* observations using the *Swift* specific FT00L XRTPIPELINE, by following the standard procedures.

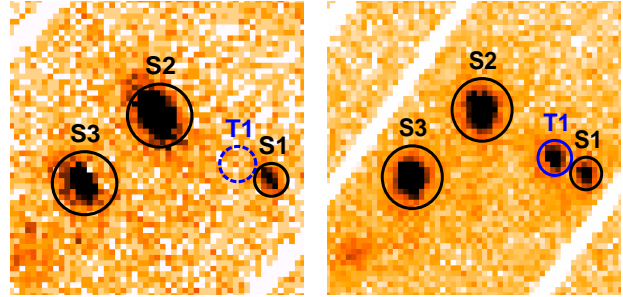


Figure 1. A 4 arcmin \times 4 arcmin portion of the EPIC-PN image including the transient source (T1) in the 2001 (left; ObsID: 0028740201) and 2010 (right; ObsID: 0655050101) *XMM-Newton* observations respectively. Three bright sources (S1, S2 and S3) were detected in both observations. The transient source, XMMU J001446.81-391123.48, was detected only in the 2010 observation.

3 ANALYSIS AND RESULTS

3.1 Source Identification

The new transient was discovered by an inspection of the image from the 127 ks *XMM-Newton* observation conducted in 2010. To determine the source position, we compared the astrometrically corrected X-ray positions of the persistent sources in 2001 and 2010 observations. In Fig. 1, we show the field of three bright sources (S1, S2 and S3), which were identified in the catalogue of Stobbart, Roberts & Warwick (2006) as source#38 (XMMU J001444.62-391135.9), 43 (XMMU J001452.02-391045.2), and 47 (XMMU J001457.00-391139.2), respectively. We also detected a new source, XMMU J001446.81-391123.48, only in the 2010 observation with positional uncertainty of 0.5 arcsec (1σ significance). This source is located within the D_{25} ellipse of NGC 55.

We searched the on-line catalogues for X-ray sources consistent with the position of XMMU J001446.81-391123.48, but did not find any likely candidates. The analysis of *Chandra* observations conducted in 2001 and 2004 did not find any sources in the XMMU J001446.81-391123.48 positional error region. Also this particular source was not catalogued in the *XMM-Newton* observations (Stobbart, Roberts & Warwick 2006) and previous *ROSAT* observations (Read, Ponman & Strickland 1997; Schlegel, Barrett & Singh 1997), but only in the third generation *XMM-Newton* Serendipitous Source Catalogue (3XMM-DR4)¹. Based on these, we concluded that XMMU J001446.81-391123.48 is a previously undetected source and it is a new transient in NGC 55.

To determine the significance of detection, we extracted the 0.3–8 keV counts from a 14 arcsec radius circle centred at position of the source (R.A.=0^h14^m46^s.81, DEC=−39°11′23″.48, equinox J2000.0). The background level was determined using a nearby source-free circular region with a radius the same as that for the source. After background subtraction, we obtained 1413 ± 42 and 721 ± 29 counts from EPIC-PN and MOS respectively; the combined detection significance is 9.4σ .

¹ <http://xmmssc-www.star.le.ac.uk/Catalogue/3XMM-DR4/>

3.2 XMM-Newton and Chandra Data Analysis

The hardness ratios (HRs) were calculated from the count rates and defined as $HR1=(M-S)/(M+S)$ and $HR2=(H-M)/(H+M)$, where S, M and H are the count rates in soft (0.3–1 keV), medium (1–2 keV) and hard (2–6 keV) bands respectively. The ratios obtained for XMMU J001446.81-391123.48 are $HR1=0.45 \pm 0.01$ and $HR2=-0.38 \pm 0.01$. We used the X-ray colour classification scheme, tuned for *XMM-Newton* data (Jenkins et al. 2005), to classify the source. Using the same colour criteria as employed by Jenkins et al. (2005), we classified this source as an X-ray binary. Although we cannot definitely classify any sources by their X-ray colours alone, but this approach is a first step to identify the class for the source.

We extracted the background subtracted light curve for the transient source based on the combined EPIC-PN and MOS camera over 0.3–8 keV energy range. The resulting light curve, binned with 800-s, is shown in Fig. 2. The short-term X-ray variability of the source was investigated by carrying out a Kolmogorov–Smirnov (K-S) test on an 800-s binned light curve and the additionally extracted 100-s binned light curve. From the K-S test, we found that the source showed a strong short-term X-ray variability at confidence level of $> 99.99\%$ in both light curves.

The source and background spectra, together with response and ancillary response files, were obtained using the standard SAS tasks. The source spectrum grouped to a minimum of 20 counts per bin and the spectral analysis was performed with *XSPEC* version 12.8.1g. The X-ray luminosity was calculated by assuming the distance of 1.78 Mpc (Karachentsev et al. 2003). The source spectrum was fitted with single-component models, power law (PL), multi-colour disk blackbody (DISKBB), and blackbody (BBODY). An absorption component (TBABS) was also added to each model. The spectrum is best described by the DISKBB model with $kT_{in} = 0.70 \pm 0.06$ keV, $\chi^2/d.o.f = 70.5/71$, while the power law model, with photon index $\Gamma = 3.17^{+0.22}_{-0.20}$, $\chi^2/d.o.f = 74.2/71$, also provides a statistically acceptable fit. In Fig. 3, the spectral fit with the DISKBB model is shown. However, spectral fit became worse (statistically) with BBODY model, $\chi^2/d.o.f = 80.1/71$, compared to the power law and disk blackbody models. The unabsorbed luminosity for the power law and disk blackbody spectral fits are, $2.40^{+0.84}_{-0.54} \times 10^{38}$ and $5.75^{+0.42}_{-0.38} \times 10^{37}$ erg s $^{-1}$ respectively. The intensity for the power law model increases indefinitely as the energy decreases, while the disk blackbody intensity decreases towards the lower energies. Thus, there are substantial differences in line-of-sight absorption and luminosity as we see in our spectral fit. These results are summarized in Table 2. We note that the column densities obtained are higher than the Galactic foreground column towards NGC 55, $N_H = 1.72 \times 10^{20}$ cm $^{-2}$ (Dickey & Lockman 1990). We tested to fix the column density at the Galactic value in fitting, but the results were significantly worse for both models. We have also fitted both EPIC-PN and MOS spectra simultaneously using both models and the best-fit values are consistent with above quoted values.

The transient source was not detected in the 2001 *XMM-Newton* observation and we estimated the upper limit on the count rate using *REGIONANALYSE* task in SAS. After accounting for the background, we calculated a 90% confi-

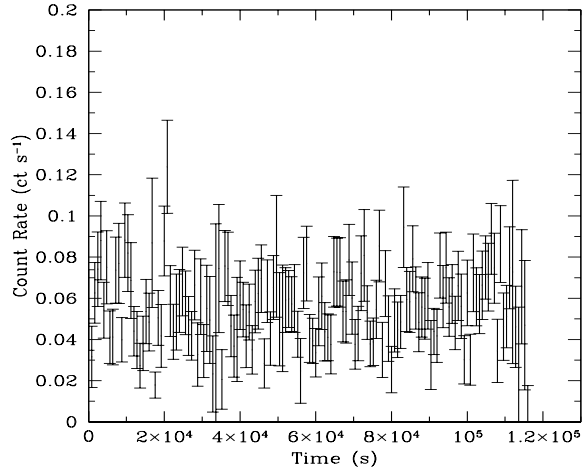


Figure 2. Combined EPIC-PN and MOS 0.3–8 keV light curve of XMMU J001446.81-391123.48. The light curve has been background subtracted and with 800 s binning.

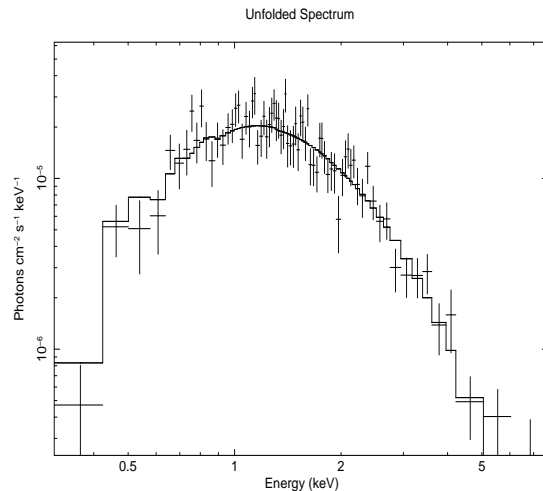


Figure 3. The 0.3–8 keV *XMM-Newton* EPIC-PN spectrum of the transient source, fitted with an absorbed disk blackbody model.

dence upper limit of $< 1.5 \times 10^{-3}$ ct s $^{-1}$ on the count rate in 0.3–8 keV. We used the absorbed disk blackbody model to calculate the flux upper limit by assuming $kT_{in} = 0.7$ keV and $N_H = 0.3 \times 10^{22}$ cm $^{-2}$. The upper limit on the 0.3–8 keV flux is $< 1.4 \times 10^{-14}$ erg cm $^{-2}$ s $^{-1}$ for this observation, which indicates that the flux from this source changed by a factor of ~ 11 . For the *Chandra* observations, we analysed the ACIS data, and no sources were found at the position of XMMU J001446.81-391123.48 in the 0.3–8 keV or 3–8 keV images. Thus, we computed the 90% confidence upper limits on the count rates, using *APRATES* task in CIAO. The upper limits in the two epochs are $< 3.2 \times 10^{-4}$ and $< 1.1 \times 10^{-3}$ ct s $^{-1}$ respectively and the corresponding flux upper limits are $< 2.7 \times 10^{-15}$ and $< 8.2 \times 10^{-15}$ erg cm $^{-2}$ s $^{-1}$. The former value constrains the source luminosity to be $< 10^{36}$ erg s $^{-1}$.

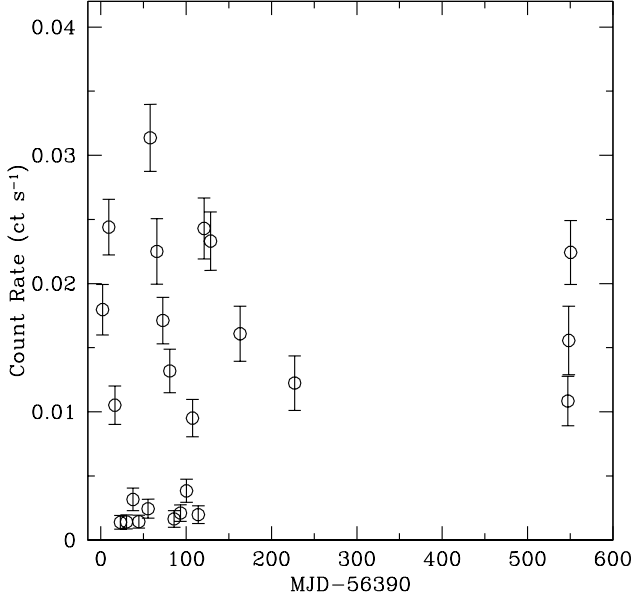


Figure 4. The 0.3–8 keV *Swift* XRT count rate for the transient source as function of observation time.

3.3 *Swift* XRT Data Analysis

In the *Swift* XRT observations, using the *XRTCENTROID* tool, we derived the position of XMMU J001446.81-391123.48 with a positional uncertainty of ~ 5 arcsec, at 90% confidence level. For each observation, we extracted source and background spectra from a circular region of radius 20 arcsec centred on the source position determined with *XRTCENTROID*. The standard grade filtering of 0–12 was used. The ancillary response files were created using the tool *XRTMKARF* and appropriate response matrix files obtained from the HEASARC CALDB.

The Fig. 4 shows the *Swift* XRT light curve in the 0.3–8 keV energy range. From the light curve, it is clear that the source exhibited substantial variability and showed distinct intensity states. During 2013 April observations, the source is in the “flaring state” and then becomes fainter on \sim day 20 in the light curve. The source remains in the “faint state” for about a month and then reaches the peak intensity (~ 0.03 ct s $^{-1}$) on 2013 June 5. This intensity then decreases gradually and becomes fainter again after a month. The source reaches the peak intensity in < 2.5 d and then declines by a factor of ~ 19 in ~ 28 d, to reach the fainter state. Thus, the source appears to have a Fast Rise Exponential Decay (FRED; Chen, Shrader & Livio 1997) kind of phenomenon in the light curve. During 2013 July – November observations, the source shows the same trend in the variations, but we could not follow up these variations because of the lack of monitoring. In addition, the source is in the rising stage during the latest *Swift* observations (2014 October).

We investigated whether the observed intensity variation could be due to the change of the source position in the *Swift* CCD. We measured the flux of the source using the best-fit power law and disk blackbody models, which considered the effective area changes due to off-axis angle

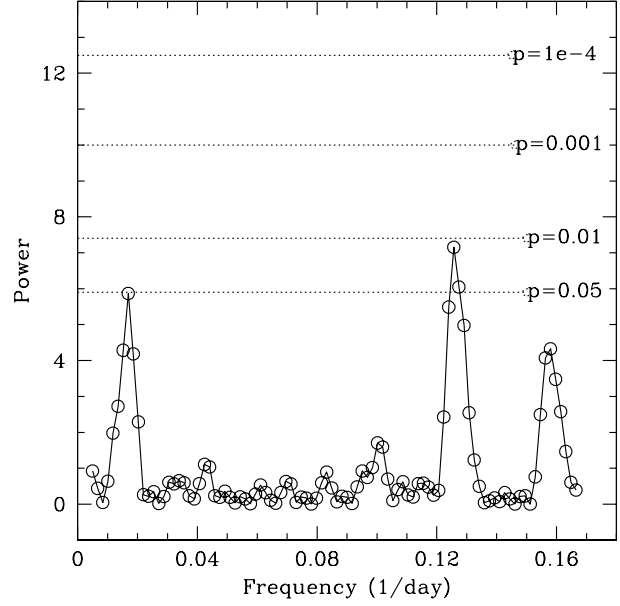


Figure 5. The Lomb-Scargle periodogram for the *Swift* observations. The dotted lines represent different significance levels of detection.

as well as the instrument response variations in the CCD. The estimated flux of the source also exhibits the variation pattern similar to that of the count rate. Thus we conclude that the intensity variation came from the source, not due to instrumental artefacts.

In order to search for any modulation in the light curve, we used the Lomb-Scargle periodogram (LSP; Lomb 1976; Scargle 1982) and found a peak at ~ 7.8 d in the LSP. However, the peak is not statistically significant ($< 99\%$ level) with a maximum power of 7.1 (See Fig. 5).

Because of the low count rate, we co-added the *Swift* data to study the spectral behaviour of the source. We defined five count rate ranges as given in Table 2 by having roughly equal numbers of total counts (within a factor of 3). The spectra of each count rate group were added by using the *FTOOL* *ADDSPEC* and the response files were weighted according to their counts. Since the statistical quality of the spectra are low, they can be well fit by an absorbed power law or absorbed disk blackbody model. The absorption column density was fixed during the fit to the best-fit values of *XMM-Newton* data. The best-fit spectral parameters are given in Table 2.

While there is no substantial difference between the power law and disk blackbody fits for 4 co-added *Swift* spectra, for the *SWIFT4* spectrum, $\chi^2/\text{d.o.f}$ are 49.9/43 and 65.2/43 from the power law and disk blackbody respectively, indicating that the former provides a better fit. We thus further studied the five individual spectra in the count rate range 0.02 – 0.025. Fitting them with a power law and a disk blackbody, 4 out of 5 spectra in this count rate group were found to have similar spectral parameters (or within the uncertainty; $\Gamma \sim 2.5$ –3.0 or $kT_{in} \sim 0.7$ –0.9 keV), but one spectrum (ObsID : 00032619020) had $\Gamma \sim 2.21^{+0.41}_{-0.38}$ for the power law or $kT_{in} = 1.23^{+0.50}_{-0.30}$ keV for the disk blackbody. The χ^2 values indicate that the power law is only

slightly more favoured, very similar to that for the 4 co-added spectra. We re-binned the spectra by removing the particular observation and fit the spectrum (*SWIFT4a* in Table 2) with both models. This fit results also show a significant difference in χ^2 between the two models ($\chi^2/\text{d.o.f}$ are 31.1/33 and 45.6/33 for power law and disk blackbody respectively). Thus we conclude that the co-added spectra can not be used to determine the exact spectral parameters of the source, because they can appear to favour the power law when different individual spectra are added.

We also fitted the spectra by minimizing the Cash (C) statistic (Cash 1979) for *SWIFT1*, *SWIFT2*, and *SWIFT5*. The C-stat values do not differ from the χ^2 values, and the spectral parameters have negligible differences ($< 7\%$). It is also noted that the X-ray luminosity of the source is above $\sim 10^{38} \text{ erg s}^{-1}$ irrespective of the spectral models.

4 DISCUSSION AND CONCLUSION

We serendipitously discovered a new transient source in NGC 55 using the archival *XMM-Newton* data obtained in 2010. The source was undetected in the *XMM-Newton* 2001 observation, and 2001 and 2004 *Chandra* observations, whose deep sensitivities indicate a flux change of at least two orders of magnitude from $< 10^{36}$ to $\sim 10^{38} \text{ erg s}^{-1}$. Thus, these observations establish that XMMU J001446.81-391123.48 is a new X-ray transient source in NGC 55.

In considering the nature of XMMU J001446.81-391123.48, the X-ray colour classification scheme of Jenkins et al. (2005) identifies this source as an X-ray binary system. The high luminosities ($\sim 10^{38} \text{ erg s}^{-1}$) during the outbursts are consistent with the luminosity range of bright X-ray binaries, and also help to rule out the low-luminosity source classes, such as magnetic and non-magnetic Cataclysmic Variables (Kuulkers et al. 2006) and Magnetars (Mereghetti 2013), as a possible candidate for this transient. Apart from the high luminosity, the source displayed a strong short-term X-ray variability in the 2010 observation, further supporting the X-ray binary nature.

There is no statistically significant difference between the power law and disk blackbody fits for the *XMM-Newton* spectrum. The best fit photon index (~ 3.2) is too high for the hard state (McClintock & Remillard 2006); furthermore, the photon index is likely too high for the steep power law state also since the disk blackbody contribution makes the SPL appear hard in the observed energy range (Barnard et al. 2014). However, the best fit disk blackbody model is consistent with the thermally dominated spectrum (McClintock & Remillard 2006), and we find this to be the most likely spectral state for the transient. Moreover, such a thermally dominated spectrum for an X-ray transient has never been seen in NS X-ray binaries, suggesting that the accretor in the transient is a black hole (Done & Gierliński 2003).

The follow-up studies with *Swift* XRT revealed the source's outburst activity and it is possibly a FRED phenomenon. During the 2013 May *Swift* observations, the source had an outburst and reached the peak intensity, by having a factor ~ 13 flux increase, within $< 2.5 \text{ d}$. After the outburst, the flux decayed exponentially with an e-folding time of $> 22.8 \text{ d}$. This time scale is consis-

tent with the e-folding time of black hole candidates in outburst (Tanaka & Shibazaki 1996; Chen, Shrader & Livio 1997; Yan & Yu 2014). There are secondary peaks occurred prior (2013 April observations) and after the outburst (2013 August observations), but the peaks only reached a level of $\sim 78\%$ of the main outburst peak. In addition, the peak prior to the outburst decayed very rapidly compared to the main outburst decay. Thus, the source possibly showed a repeated outburst. The outburst recurrence period would be about a month, which is much smaller than the reported recurrence periods for the NS and BH systems (Kuulkers et al. 1997; Masetti 2002).

Our co-added *Swift* spectra only provide approximate spectral properties for the source. In the fainter state (*SWIFT1*), the spectrum is described by power law with index ~ 2.5 or disk blackbody with $kT_{\text{in}} \sim 1.0 \text{ keV}$. The source changed its luminosity by an order of magnitude and reached $\sim 2 \times 10^{39} \text{ erg s}^{-1}$ in the *SWIFT5* compared to *SWIFT1*, but not much change in the power law index or disk blackbody temperature. Although the large uncertainties on the parameters do not allow us to draw a clear conclusion, the results suggest that the source changed its luminosity by an order of magnitude without change in its state. In the observations, the X-ray luminosity of XMMU J001446.81-391123.48 is $\sim 30 - 400\%$ of the Eddington limit for a canonical $1.4 M_{\odot}$ NS, again suggesting that the primary is more likely a BH.

Finally, the transient source is located in the bar region which is displaced ~ 3 arcmin from the geometrical centre of NGC 55 (Robinson & van Damme 1966). The Very Large Array observations at 6 cm and 21 cm revealed that the radio continuum emission is concentrated on the bar region (Hummel, Dettmar & Wielebinski 1986). Moreover, the 6 cm radio emission is dominated by a triple source and this triple coincides with discrete H I and $\text{H}\alpha$ emission. Also, the on-going star formation rate (SFR) in the bar region is consistent with the global SFR of NGC 55 ($\sim 0.22 M_{\odot} \text{ yr}^{-1}$; Engelbracht et al. 2004) and suggests that the bar region is a young star formation complex with an age of $< 2 \text{ Myr}$. Thus, the transient source could be a young stellar system in the bar region of NGC 55.

In summary, XMMU J001446.81-391123.48 is a new X-ray transient in the young stellar region of NGC 55, possibly being a black hole X-ray binary. The repeated outbursts and prominent radio emission from the young stellar region made this source as a good candidate for the further follow-up studies at X-ray and radio wavelengths. Such multi-wavelength studies can shed further light on the nature of XMMU J001446.81-391123.48.

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Table 2. Spectral Fitting Parameters of XMMU J001446.81-391123.48.

Data	Count Rate ^b	n_H ^c	PL ^a Γ ^d	L_X ^e	$\chi^2/d.o.f$ ^f	n_H ^c	DISKBB ^a kT_{in} ^g	L_X ^e	$\chi^2/d.o.f$ ^f
<i>XMM1</i>	—	$0.67^{+0.08}_{-0.07}$	$3.17^{+0.22}_{-0.20}$	$38.38^{+0.13}_{-0.11}$	74.2/71	$0.32^{+0.05}_{-0.04}$	$0.70^{+0.06}_{-0.06}$	$37.76^{+0.03}_{-0.03}$	70.45/71
<i>SWIFT1</i>	0.00 – 0.01(10)	$0.67(f)$	$2.55^{+0.43}_{-0.39}$	$38.19^{+0.14}_{-0.12}$	9.4/11	$0.32(f)$	$0.98^{+0.35}_{-0.23}$	$37.79^{+0.07}_{-0.08}$	11.7/11
<i>SWIFT2</i>	0.01 – 0.015(4)	$0.67(f)$	$2.75^{+0.37}_{-0.34}$	$38.85^{+0.13}_{-0.12}$	9.9/14	$0.32(f)$	$0.88^{+0.21}_{-0.17}$	$38.37^{+0.06}_{-0.06}$	12.5/14
<i>SWIFT3</i>	0.015 – 0.02(4)	$0.67(f)$	$2.76^{+0.33}_{-0.28}$	$39.04^{+0.12}_{-0.10}$	29.3/23	$0.32(f)$	$0.94^{+0.19}_{-0.16}$	$38.57^{+0.05}_{-0.05}$	34.3/23
<i>SWIFT4</i>	0.02 – 0.025(5)	$0.67(f)$	$2.81^{+0.21}_{-0.20}$	$39.16^{+0.08}_{-0.07}$	49.9/43	$0.32(f)$	$0.84^{+0.11}_{-0.10}$	$38.66^{+0.03}_{-0.04}$	65.2/43
<i>SWIFT4a</i>	0.02 – 0.025(4)	$0.67(f)$	$2.89^{+0.25}_{-0.23}$	$39.19^{+0.10}_{-0.09}$	31.1/33	$0.32(f)$	$0.80^{+0.13}_{-0.11}$	$38.67^{+0.04}_{-0.04}$	45.6/33
<i>SWIFT5</i>	0.03 – 0.035(1)	$0.67(f)$	$2.65^{+0.51}_{-0.41}$	$39.22^{+0.18}_{-0.14}$	15.9/11	$0.32(f)$	$1.00^{+0.29}_{-0.23}$	$38.80^{+0.07}_{-0.08}$	16.9/11

Note. — ^aSpectral models used for fitting: PL - power law continuum; DISKBB - multi-colour disk blackbody. ^bCount rate range used for the co-adding the *Swift* data and the no. of observations co-added are given in bracket. ^cAbsorption column density, including Galactic absorption, in 10^{22} cm^{-2} . ^dPower law index. ^eUnabsorbed 0.3–8 keV X-ray luminosity in erg s^{-1} , calculated by assuming the distance of 1.78 Mpc (Karachentsev et al. 2003). ^fThe $\chi^2/d.o.f$ values for the model. ^gInner disk temperature in keV.

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